THE

MODERN PRACTICE

OF

PHOTOGRAPHY:

BY

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PREFACE.

In one form or another, some of these papers have been presented to the public for the last twenty years; the Author would not be far out in stating, that as many as thirty thousand copies of that part of this treatise, which relates to the production of a negative, have been issued, rewritten from time to time, as new processes made this necessary. It is only of late years that the papers referred to, with others, have been published in the present form, making a presentable whole, both for the use of would-be photographers, and for those more advanced. In this new garb they found a publisher, and were duly laid before the literary chiefs, to be by them either passed over in silence, struck with a fatal death-blow, or received with favour. The Author finds his treatise in the latter position; it is, therefore, with much gratitude that he seizes this opportunity of thanking those who, by their flattering reviews of his work, have enabled him again, so soon, to write another edition. He again desires to direct earnest attention to the new chapter, devoted to that most important of all photographic subjects, "The Permanency of Silver Prints."

For the convenience of experimentalists, and those who wish to carry under one cover other processes and tables, a few blank pages have been stitched in at the end of the *bound* copies.

10, *Pall Mall, London.*

"I have said, and I abide by it," cries Voltaire, "that the fault of most books is their being too "long."

"A writer who has reason on his side will always "be concise."—BISHOP HORNE.

INTRODUCTORY SKETCH.

PROBABLY no modern science or art can boast of so many roads to success as that which owns itself the servant of the sun. It is easy to understand why this should be so; for all things, animate and inanimate, are affected by the sun, which at the same moment gives us both light and life, and is a fertile source of chemical decomposition. It becomes, therefore, evident that the slightest investigation, the mere cursory examination of the many valuable storehouses of knowledge, is sufficient for developing that which at first sight appears new, but which, in reality, is only proof of the statement above made, that all bodies are more or less acted upon and changed by the agency of light.

Hence the innumerable processes in photography, which spring up daily, giving constant occupation and food to the experimentalist, engaging earnestly his attention, and so absorbing his interest by a success more or less certain, as to make the pursuit of this art, probably the most fascinating, the most exciting, and the most productive of results of any followed by the intelligent and intellectual classes of the present day.

If the above paragraph has been carefully read, it will be easily seen that as there are many roads pointing to the same end, so, in proportion to their number, will be found the difficulty in selecting that path which the novice will gladly seek, as leading direct to a successful practice of the art in question. It will be my endeavour to point out that road; and in doing so, I would not for a moment disparage the opinions of others, but merely show, without turning either to the right or to the left hand, how perfect results may be obtained; but, in doing this, I feel that brevity must take the place of a system more prolix, and to some minds, more agreeable. Let, if you will, these pages be a primer—a first lesson on one of many processes; yet the object I have in view is to put before those who require instruction on the subject of photography, a pamphlet which shall enable them at once, not only to succeed, but, with a little practice, to rival those who stand foremost as the most successful votaries of this engaging art.

Now it would hardly do, from this preamble, to descend suddenly to a process, without feeling sure that the reader, who, perchance, may be altogether a novice, has some knowledge of the principles on which the art of photography is based; a writer must have no slight acquaintance with his subject who can make a complex matter clear and intelligible to the understanding of his reader by the use of a few paragraphs only. I despair of doing this to my own satisfaction, but, nevertheless, such an attempt

has to be made, and in making it my aim shall be rather to excite the interest and attention of a student, so as to compel him to turn for fuller information on the various heads of the subject under notice, which may be found by making reference to works on optics and chemistry.

The first question, What is light? naturally suggests itself. In answer, this much is known: light comes to us through the medium of our atmosphere, pure and white, yet it is easily decomposed; its rays, analyzed and divided by means of the prism, show seven principal colours, each colour has its own property, and specifically its own chemical action. It is with this latter fact that we have to do, our whole practice of photography depending on the actinism of the violet colour and the invisible rays beyond, as shown by chemical experiment to exist in the spectrum; the red and yellow rays at the opposite end, although most luminous, affect only in a slight degree chemical bodies. It becomes, therefore, evident, bearing this fact in mind, that photographic lenses must be constructed, not possessing the power of giving the most luminous and, consequently, the most brilliant image only, on a ground-glass, placed at a point termed the focus of a lens, but the visual and chemical foci must be blended, so to speak; this, the skilful optician effects by combining lenses of various curves and densities, with a view of obtaining at the same focus two distinct powers, light and actinism, each, under ordinary conditions, being refracted at different distances. I need only remark that the

problem has been well and satisfactorily worked out by our great opticians, who have also given to photographers a variety of useful combinations of lenses, not dreamt of in the earlier days of their art.

I have shown already that light produces chemical change in bodies, but before proceeding with my explanation in this direction, as the picture to be formed is a monochrome made up of light and shade only, it will be as well to feel sure that the novice clearly understands what would be the effect of throwing a shadow by any means whatever on to a piece of white paper, prepared in such a manner as to be visibly affected by exposure to diffused light, or to the sun's rays; the effect, of course, will be to produce a modification of the action of light on the parts so shaded, and in proportion to the intensity of the shadow, so will be the want of intensity in the action of light on the prepared paper. Now, in order fully to realise this in a manner evident to the senses, we must make use of paper prepared with chloride of silver in the dark; the albumenized paper of commerce, when floated on a solution of nitrate of silver, becomes such a paper; it must be then carefully dried either in the dark or in yellow light; a slip of this paper exposed to white light, either natural or artificial, immediately changes colour, the silver being reduced, and according to the time of exposure so will be the intensity of the colour, changing from light brown to bronze.

I have before stated that the shadow of any object thrown upon this paper during its exposure to light,

will, according to its intensity, protect the prepared surface; and should the hand, with its fingers extended and held between the paper and the source of light, be the object chosen, a representation of the form of the fingers on the sensitive paper will be the result. In this we find the key to the formation of a photographic picture; bearing it in mind, it is easy to understand that which follows. Now, the lens and camera are the instruments used by the photographer for the production of the image of any object capable of being represented by light and shade. It is, I think, fair to presume that a person wishing to follow the art of photography will have acquainted himself with at least this fact, that a lens fitted to the outside of a dark box, so arranged that one part shall slide within the other, does, at a certain point called a focus, which varies with the distance of the lens from the object, produce a representation on a ground-glass of any object at which the lens may be pointed. If the ground-glass be made movable, and a slide with a shutter properly arranged, containing a plate sensitive to light, be made to occupy exactly the same position as that occupied by the ground-glass, it follows that a representation of the object will fall upon the sensitive plate placed as described. This is the first step in the process by which photographic views, portraits, &c., are produced. I will now proceed to speak of the chemicals used for preparing the plate that has been, as above shown, placed in the slide occupying the position of the ground-glass. I must, however, pause for a moment to explain some distinct

properties possessed by different chemical preparations sensitive to light. I have already shown how chloride of silver is affected, the change which takes place being visible, and, so to speak, accumulative: this change is, however, slow, and cannot be accelerated or developed to any further extent when the light has been withdrawn. It is, therefore, evident that such a process, although excellent for the production of the positive photograph on paper, is not suited for the preparation of a highly sensitive plate to be placed in the camera for the purpose of portraiture. We find in the iodide and bromide of silver a peculiar property, viz., that of receiving an impression rapidly, which, although at first invisible, is capable of being further developed and intensified. It is with these chemicals that the sensitive plate is prepared. The most convenient vehicle for holding the salts in solution, capable of being easily transformed into the iodide and bromide of silver, is collodion, to which I must now allude briefly.

Collodion is a solution of pyroxyline (gun-cotton) in ether and alcohol, which, when poured upon glass, sets readily, leaving a film, structureless, transparent, and porous; it, moreover, adheres perfectly to the glass. If a solution containing a salt of iodine and bromine be added to a solution of nitrate of silver, a precipitate of iodide and bromide of silver immediately takes place; it can, therefore, be easily understood, that if the same salts be dissolved in collodion, and the film, when properly set on the glass, placed in a bath of nitrate of silver, the in-

soluble salts, iodide and bromide of silver, are formed and retained in the body of the film, rendering that which was transparent, opaque and yellow. Such a film is more sensitive to light than any with which we are acquainted; a glass prepared with this sensitive film may therefore be, in the wet state, at once transferred to the dark slide and placed in the camera, where it occupies the position of the ground-glass; the lens being uncovered, a few seconds' exposure is sufficient to impress this highly sensitive plate with an invisible image.

At this stage it will be instructive to explain what takes place when certain solutions are made use of for the purpose of developing the latent image with which the film has been impressed; and bearing in mind what has been said in the first part of this Essay concerning the non-actinic quality of yellow light, it will be hardly necessary to remark that the preparation of the sensitive plate and its subsequent development must be performed by light passed through a yellow medium, such as glass stained of a proper colour.

Proto-sulphate of iron is the deoxidiser now generally used for continuing that change which has been effected on the plate in the camera by light. On applying a solution of this salt, the image is seen to develop, and precisely in proportion to the light reflected from the various parts of the object copied, so will be the intensity or blackness of the parts of the plate thus acted upon. This first picture is termed a negative, the lights and shades, as seen in

nature, being in it reversed; for instance, the sky of a landscape, as reflecting most light, would be black, and the dark-shaded parts of trees would be represented on the plate as parts much less opaque, shading off to a point at which the glass has been entirely protected by the deep shade of foliage; or a portrait may be taken as another illustration: in this case, the face would be more or less dark, the white shirt black, and dark clothes more or less light in the negative.

Now the development of this image, as I have shown, must take place in yellow light; it is evident, therefore, that all sensitive salts should be removed before viewing it by daylight, and thus the further action of white light is arrested. For this purpose it is only necessary to wash off the developing solutions with water, and act upon the iodides and bromides by means of any solvent capable of removing these salts from the film; the cyanide of potassium performs this operation effectually; and lastly, when the excess of cyanide has in its turn been removed by washing with water, the negative picture is completed, and may now be dried and varnished. When viewed by transmitted light, a perfect representation of the subject is seen, the lights and shades being reversed. Such a picture, although highly interesting, and beautiful in the extreme, would be considered useless as a work of art; moreover it is upon glass, consequently liable to injury, It is at this stage, therefore, that we avail ourselves of the paper process before alluded to; and the advantage of such

a process for the production of the prints, or positive pictures, as they are called, is at once apparent.

The negative picture thus produced may be looked upon as a matrix for the production of any number of positives: the process is most simple; and if the reader comprehends that which has been already written, it becomes evident that light passing through the negative on to a sensitive paper, prepared as before described, will be admitted or intercepted in proportion to the resistance offered to its passage by the opaque and shaded parts of the negative, and the resulting positive on paper will be, consequently, the reverse of that on glass, the lights and shades being found now to occupy their correct positions. This end is brought about by merely placing the face of the negative in close contact with the surface of the sensitive paper, subjecting both to very slight pressure, in a suitable frame, sufficient to prevent shifting and to insure perfect and equal contact; they are now exposed, so placed, to the action of light for the proper time, this being ascertained by an occasional examination of the print during exposure.

As in the completion of a negative picture, the superfluous sensitive salts must be washed out; an agreeable tone is then imparted to the proof by immersion in a solution of chloride of gold, and the excess of chloride of silver removed by means of a proper solvent (hyposulphite of soda); the print is then freely washed in water, dried, and mounted.

The finished photograph is a marvel of science; it calls forth the admiration even of him who is little

skilled in the technicalities of art, appealing as it does to a new sensation, that vibrates with a strange pleasure on viewing for the first time a picture having reality in the perfection of its light and shade, the gradations produced being so delicate and subtle, as to set at defiance both the painter's brush and the graver's tool. In this consists the charm, the perfection, and the individuality of photographic art.

HOW TO MAKE THE NEGATIVE,

USING

COLLODION BROMO-IODIZED

FOR

IRON DEVELOPMENT.

1.—THE edges of the glass should be ground all round, also slightly on the surface of the edges; this prevents contraction of the film, enabling it to resist the action of a heavy stream of water; mark one side in the corner with a diamond, and upon this side bestow the greatest care.

2.—TO CLEAN THE GLASS IF NEW.—Make a mixture of Spirits of Wine and Solution of Ammonia, equal parts: render it as thick as cream with Tripoli; with a piece of cotton-wool kept for this purpose rub a small quantity over that side marked as described, wash well under a tap of water, and wipe dry with a piece of old linen, washed without soap, and kept scrupulously clean for this purpose. Plates should not, however, be cleaned in the operating room with the above mixture, the vapour of ammonia might prove injurious to the chemicals.—*Vide* also my paper on cleaning the plate.

3.—Now polish with an old white silk handkerchief; if this latter precaution be not taken, small

particles of linen will be left upon the plate; these are perhaps only seen when draining off the collodion, they form nuclei and eddies, checking the collodion in its course; some of these minute fibres are washed off and contaminate the next picture. To all lovers of clean pictures my advice, therefore, is, having well dried the plate with old linen, lay it, clean side upwards, upon a few sheets of common glazed demy paper (not blotting), and rub it hard with the silk until sensibly warm; this has the double advantage of dispersing fibres and moisture, for all glass plates are slightly in a hygrometric condition. Double the silk rubber up to form a pad, and with this the glass must be firmly dusted down just before pouring on the collodion, which will then run most evenly; if the coated plate is now viewed by transmitted light not a speck or blemish will be seen upon it. When a plate, cleaned as above described, is breathed upon, the moisture does not evaporate slowly, but *flies off*. Do not be afraid of putting the glass into an electrical condition with the silk rubber; on this account objections have been raised to the use of silk; practically, however, I find it a most valuable auxillary in this starting point of the process, the perfect manipulation of which makes an important difference in the value of the finished picture. What can be more unartistic and annoying to an educated eye than spots, patches, stars, and sky-rockets, the forms and shapes of which rival, in numberless variety, a display of fireworks? Let us not, therefore, be contented with pictures, however good in other respects,

presenting these deformities—so many blots on the photographic escutcheon.

N.B.—To Clean a Glass after having used it, when not Varnished.—Wash off the collodion film with water, then clean the marked side with plain Tripoli and water, and dry as above.

To Coat the Plate.—First remove all the particles of dried collodion from the mouth of the bottle. Now pour upon the centre of the cleaned glass as much collodion as it will hold; do not perform this operation hurriedly, take time, and systematically incline the plate in such a manner that the collodion may run into each corner in succession; when perfectly covered, pour off gently the excess into the bottle at one of the corners nearest to you; with observation and practice, dexterity is easily acquired. There are many ways of coating the plate; each person will adopt that which practice teaches him is best. The pneumatic plate-holder is a convenient little instrument to use for holding the plate whilst pouring on the collodion; it may be used for both small and large plates.

N.B.—Keep the corner of the glass plate in contact with the neck of the bottle whilst pouring off the collodion, otherwise the film will be wavy in places.

4.—As soon as the collodion has properly set, plunge the prepared glass gently, without stopping, into the Nitrate of Silver Bath,* now move it at once

* *Vide* **Instructions for Making the Nitrate of Silver Bath.**

from right to left several times without, at first, taking it out of the bath. This motion tends very much to a uniform action of the Nitrate of Silver.

5.—Allow the prepared glass to remain in this bath from five to ten minutes, according to the temperature. Move it up and down three or four times whilst in the bath, in order to get rid of the greasy appearance on the surface; drain it, but not too closely, by standing, for a few seconds, the bottom of the plate on a pad of blotting-paper; when in the frame, place upon the back a piece of common red blotting-paper to absorb moisture, the two lower silver wires should be covered with slips of blotting-paper; the sooner it is placed in the camera the better.

6.—The time of exposure can only be ascertained by practice—no rules can be laid down—and I am unacquainted with any royal road but that of experience, leading to constant success in this most important point. It may, however, be broadly stated that the exposure for a wet plate will vary from one second to one hour, taking for the shortest exposure named objects in the horizon, and for the longest the interior of a badly-lighted room or church. As a rule, expose long enough to give time for impressing objects in shadow, let the high lights and distances take care of themselves. The average exposure for a portrait in a photographer's studio is from five to thirty seconds, varying with the light, aperture, and focal length of lens. For a landscape the difference will be more marked, say from fifteen seconds to two minutes. It is sometimes difficult to judge of the

quality of the light as regards its actinism, I have invariably found that in proportion to the inconvenience that accompanies the act of viewing the sun with the eye, so will be the chemical activity of the rays. A dull red theatrical-looking orb, that may be looked at with impunity, is practically, for all photographic purposes, useless.

7.—The plate having been taken from the camera, and placed upon a levelled stand, or held in the hand, develop immediately the latent image with the following solution:—

IRON-DEVELOPING SOLUTION.

Proto-sulphate of iron	¼	oz.
Glacial acetic acid	¼	„
Spirits of wine	½	„
Distilled water	8	ozs. Mix.

Pour on of this solution only enough to cover the plate easily, commencing at that edge of the negative which stood uppermost in the camera, move the solution to and fro until it has become intimately mixed with the silver on the plate, then pour off into the developing glass, and *at once* return it on to the plate;* when as much intensity has been obtained as possible with the iron developer, it should be thoroughly removed by washing with water; any intensity may be obtained afterwards by using either of the following solutions:—

* *Vide* paragraph 7, page 23.

INTENSIFYING SOLUTION.

Pyrogallic acid	6 grs.	
Glacial acetic acid	¼ oz.	
Distilled water	6 ozs.	Mix.

A few drops of a 30-gr. solution of nitrate of silver, the quantity to be regulated according to the intensity required, to be added, at the moment of using, to as much of the pyrogallic solution as may be necessary.

INTENSIFYING SOLUTION.—(Another Form.)

No. 1.

Pyrogallic acid	8 grs.
Citric acid	20 „
Distilled water	2 ozs.

No. 2.

Nitrate of silver	8 grs.
Distilled water	2 ozs.

Mix small quantities of the solution Nos. 1 and 2 in equal portions, the moment before using.

The pyrogallic solution, made with good acetic acid, may be kept for a month or more in a cool place. Nevertheless, if the conditions of light and situation are unfavourable, I should prefer this solution just made. The iron solutions act best when freshly prepared.

It is supposed by some that a prolonged action of the iron developer produces fogginess; this may

be the case when impure or improperly prepared collodion is used, but certainly not when this preparation is pure and of the proper quality.

Some operators are in the habit of flushing the plate with the iron solution, causing it to run off and carry with it all the silver on the plate. This practice cannot be too strongly condemned. A protest against it by a writer in the "American Journal of Photography," is made in such forcible language, that I give it in his own words, at the same time adding, as the result of my own observations, that no amount of silver used afterwards compensates for the loss of that which has been carelessly washed off by dashing on the developer. The silver retained on the plate, and present during the action of light upon it in the camera, imparts a peculiar quality to the developed picture. The writer referred to above, says:—

"The reckless style of manipulation seems to me to be the origin of a vicious style of developing, which with many has become a habit, and a practice which is sometimes defended. I allude to the dashing on the developer, and deluging the plate with it. Did it ever occur to those who develop in this way, that the developer was needed on the plate, and not in the sink? that the silver which might have assisted to strengthen an image is swept away beyond reach? In my opinion, about half the re-developments and strengthenings might be omitted, except for this washing away of the life of pictures.

"The rule ought to be in treating a plate, not to spill a drop of collodion, developer, or fixing. Some

may fear fogging, or over-development, by following such a system. But let such try the plan thoughtfully, and they will find their fears are groundless. Let them recall their ordinary rules, and the seeming difficulties vanish. If the developer is too active, add acid, or dilute.

"The chief item in my receipt for intense negatives is, Do not spill the developer."

I have heard it remarked by excellent operators, that unless the plate be flooded in the way described, the negative would be stained all over; such an evil can only be due to the imperfect quality of the collodion used, and my advice is, under such circumstances, to let it go the way of all worthless rubbish.

8.—When the image is sufficiently intense, wash freely with common filtered water; then pour on a saturated solution of hyposulphite of soda, which should immediately remove the iodide of silver; wash again well with water; allow as much as the plate will hold to soak in for at least a quarter of an hour, changing the water occasionally, to remove all traces of hyposulphite; lastly, wash the plate with a little distilled water, stand up to dry, and, if required, varnish either with spirit or amber varnish.

The following solution is also very commonly used for fixing the negative:—

Cyanide of potassium	¼ oz.
Water	12 ozs.

REMARKS ON THE USE

OF

BROMO-IODIZED COLLODION

AND

SIMPLE IODIZED COLLODION.

THE characters of Bromo-Iodized Collodion are marked and well defined; they may be briefly stated:—

1.—Its special fitness for use with an iron developer, giving the maximum amount of half-tone obtainable.

2.—A peculiar property of resisting solarization of those parts of the image strongly lighted, which enables the operator to expose his plate long enough to bring out details in deep shadow, without impairing the definition of those portions of the picture first impressed on the plate.

It will be at once gathered from these remarks that a bromo-iodized collodion gives the utmost amount of half-tone obtainable, when used with an iron developer.

SIMPLE IODIZED COLLODION.

Properties briefly stated:—

1.—Its special fitness for use with a pyrogallic acid developer, with which the maximum of intensity is obtainable.

2.—Its suitability also for use with an iron developer, with which a little more detail is obtained, and a modification of the intensity of the image.

The collodion for use with pyrogallic acid only as a developer, is iodized, either with iodide of cadmium or iodide of potassium, but whatever iodide be used, no salt of bromine should be added to the collodion.

Formerly this was the only preparation used by photographers for the production of negatives, but now it has been superseded by the bromo-iodized collodion for iron development. Considerable intensity is easily obtained with this preparation; there is, however, always a danger of producing negatives too black and white, the contrasts being too violent.

It is only necessary to give the formula for pyrogallic acid developer, for the method of working and rules to be observed are precisely the same as those described in the preceding chapter.

Pyrogallic Solution.

Pyrogallic acid.....	6 grains.
Glacial acetic acid	$\frac{1}{4}$ oz.
Distilled water	6 ozs. Mix.

In cases where it is desirable to add to the intensity of the negative, a few drops of a 30-grain solution of nitrate of silver may be mixed with the developing liquid towards the end of the development.

The collodion iodized with cadmium retains its sensitiveness without change for years. The collodion iodized with potassium undergoes a slow change when kept iodized.

ATTENTION TO THE FOLLOWING RULES AND CAUTIONS WILL ASSIST THE OPERATOR IN THE PRODUCTION OF PERFECT PICTURES.

1.—Do not disturb the deposit which will occasionally be found at the bottom of the bottle containing the collodion.

2.—Remove all particles of dried film from the neck of the bottle before pouring the collodion on the plate. For small plates, pour from a small quantity of collodion; cover the plate slowly and systematically, so as to favour evaporation, and leave a coating sufficiently thick to give a good creamy film. It is possible, by a totally opposite method of proceeding, to produce a poor, thin negative.

3.—Never use damp cloths, leathers, or buffs, for giving the final polish to the plate; negatives with an indistinct and muddy surface are frequently produced from this cause.

4.—Let the film set properly before immersion in the nitrate of silver bath; its condition can be ascertained by gently touching the lower part of the coated plate with the end of the finger. The setting of the film is much affected by temperature and the condition of the atmosphere. On the ground-floor it sets slower than at the top of the house. Negatives may be produced at low temperatures, but, for suc-

cessful working, the temperature of chemicals and of operating-room should not be below 50 degrees.

5.—Never omit to pass a broad camel-hair brush over the plate just before pouring on the collodion.

6.—Bear in mind that, as light is the producing agent, so will it prove a destructive one; not less than four folds of yellow or orange tammy should be used to obstruct white light; and in that case the aperture covered should be no larger than is necessary to admit sufficient light for working by. Examine occasionally the tammy; when this material is used to exclude white light it becomes bleached by constant exposure. Do not trust alone to any coloured glass; no glass yet made is adi-actinic under all aspects of light and conditions of exposure.*

7.—When the exposed plate is taken from the frame an accumulation of the silver bath will be found at the lower end: pour on the developing solution at the *upper* part of the plate; the excess of silver is by this means diluted before being made again to traverse the plate. With a little dexterity it is possible so to pour on the whole of the developer at the upper part of the plate, that it may be caught again in the glass if allowed to flow off at the lower end; it should then be at once poured back over the plate. By this means a uniform action of the developer is produced, and some forms of streaks avoided.

8.—Should the negative require intensifying, care-

* *Vide* page 66.

fully wash off all traces of the first developing solution before proceeding to intensify. This operation may be performed either before or after the iodide is removed by fixing.

9.—Glass baths are preferable to porcelain, ebonite, or gutta-percha baths for solution of nitrate of silver.

10.—In using either spirit or amber varnish, before pouring it off, keep the plate horizontal a few seconds —this gives time for soaking in, and prevents the formation of a dull surface arising from too thin a coating.

11.—Rub the lenses occasionally with a soft and clean wash leather; the rapidity of action is much influenced by the brightness of the lenses; their surfaces are constantly affected by moisture in the atmosphere, which, condensing, destroys the brilliancy of the image.

12.—The white blotting-paper used for some photographic purposes is not suitable for filtering solutions; that only should be employed which is made for this purpose, and is sold under the name of filtering-paper.

13.—Hyposulphite of Soda.—A great deal of rubbish is sold under the name of this salt; as a test of its quality, 1½ drachms should entirely dissolve in 1 drachm of water, and this solution should dissolve rather more than 4½ grains of iodide of silver.

14. — Chemicals. — The purity of photographic chemicals cannot be too strongly urged—the cheapest are not always the most economical. The commercial preparations are generally not to be depended upon;

as these, though perhaps unadulterated, are, strictly speaking, not chemically pure. It is best to procure them from well-known chemists, who understand the purpose for which they are intended, and make the preparation of these substances peculiarly a branch of their business.

15.—Never leave chemical solutions exposed in dishes; when done with, pour them back into glass-stoppered bottles and decant for use from any deposit, or filter if necessary.

16.—In all photographic processes it is absolutely necessary to be chemically clean; and this sometimes is not easy. As a rule, never be satisfied with cleanly appearances only, but take such measures as shall insure the absence of all extraneous matter in preparing the solutions, cleaning the glasses, dishes, &c.

17.—All stains on the hands, linen, &c., may be removed by means of cyanogen soap or cyanide of potassium, which should be applied without water at first, then thoroughly washed off. To assist the operation, the hands may be now gently rubbed with a fine piece of pumice-stone, when the stains quickly disappear.

NOTES.

1.—When working with a double lens in the open air, or in situations where there is much light, the full aperture of the lens being used, it is necessary to provide against the action of diffused general light which, under these circumstances, enters the lens, destroying the brilliancy and intensity of the image—in fact, acts chemically over the plate; thus giving a muddy, flat, or otherwise imperfect picture—an appearance corresponding to the fog produced by some collodions. This general action of diffused light, during the exposure of the plate in the camera, interferes subsequently with a prolonged or even necessary development. My attention was drawn more particularly to this fact, from the circumstance of having to make alterations in my glass room for the purpose of obtaining twice the amount of light; when completed, I was quite unable to take a picture, simply because the extra light introduced, although a north light, interfered with the darkness necessary for the production of clean and vigorous pictures in the camera. The remedy for this is simple: I screw on to the front of my camera a sliding dark box, open at the end. I can, by this means, regulate the amount of protection according to circumstances, viz., from twelve to twenty-four

inches; brilliant and intense negatives are thus obtained. Now remove the protector, and the reverse is evident; the picture is flat, faint, shows a want of detail, and a general tendency to blacken over under the influence of the developer. It is obvious that this arrangement is more particularly useful when double lenses with large aperture are used.

2.—Under all circumstances, throw a large black cloth over the slide when placed in position, and if the camera has a sliding front, let the black cloth hang a few inches over the front of the camera, before drawing up the shutter; now put the left hand underneath the cloth, place this on the top of the slide to keep it in place, and with the right hand outside feel for the leather tongue; pull up the cloth and shutter together; the cloth should not be removed until the slide has again been closed. This sufficiently indicates the necessity for preventing ever so slight a ray of light attacking the plate during the exposure. First-rate pictures cannot be obtained in the open air unless this precaution be taken.

3.—Use as little light as possible in the dark room; the quantity must be regulated by the aspect of the window through which the yellow light is admitted. A candle would entirely spoil a collodion plate, unless protected by means of a yellow calico shade, or orange-coloured glass.

4.—Condition of collodion best suited for different purposes:—For portraiture with a double lens, mix the collodion twelve or twenty-four hours before it is required for use; the picture thus obtained is more

intense than when collodion recently mixed is used. For works of art and still objects, &c., collodion a week old is best; and for landscapes, a greater general intensity and sufficient rapidity of action is obtained, when the collodion has been mixed a month. For black and white objects, *i.e.*, engravings, &c., use collodion three months old.

5.—Collodion in hot weather may become too thick to use conveniently; it should then be slightly diluted with a mixture made of two parts of ether and one part of absolute alcohol of known purity, and well shaken. As a rule, the less collodion is diluted the better. A properly prepared collodion maintains its fluid condition; whereas a collodion prepared with unsuitable pyroxyline will gelatinize, in which state it cannot again be restored to its original condition.

6.—THE CAMERA DESCRIBED.—A good and well-made camera is more or less useful in proportion to the skill bestowed on its construction. The best seasoned wood and most accurate measurements are necessary; moreover, every part must be easily under command. A camera should be made on the most simple principles; all unnecessary complication of screws and joints avoided. Let *strength*, *simplicity*, and *correct* workmanship be the primary considerations. A plain sliding trunk camera, half the bottom board hinged to turn up—thus forming a box in which to pack and carry some of the necessary apparatus, and a stout handle screwed to the top, is a convenient instrument. The camera should also

have a sliding front, by means of which the lens is made to move vertically, for the purpose of cutting off foreground—an arrangement at times desirable when other portions of the picture are of more importance. The piece of ground glass upon which the image falls must be finely ground plate; and if an upset or smash occurs, take care, in replacing, that the ground side faces the *inside* of the camera. Double slides are most convenient for the dry-plate processes; these slides are hinged and open in the centre; the sensitive plates are then placed face downwards, and shut up back to back, with two pieces of red blotting-paper or a diaphragm between them. The slide for wet collodion is, of course, constructed on a different principle; it contains a frame to hold the collodionized glass, which rests upon silver wires inserted diagonally at each corner; the loose frame is hollowed out to prevent the wood coming in contact with the wet silvered plate. A very slight imperfection in the collodion slide, sufficient to admit an infinitesimal ray of light, would have a damaging effect upon the beauty and perfection of the negative picture.

Expanding or bellows cameras are now excellently constructed; they are very light and rigid; the focus can be obtained with great precision and ease by means of a screw movement.

THE LENS.—GENERAL REMARKS.—It is a mistaken economy to purchase cheap and inferior lenses: if photography be worth doing at all, it is certainly worth while to do it well. A good lens is the pho-

tographer's *sine quâ non*. The double combination is used for portraits, and in all cases where great rapidity of action is desirable. These lenses do not cover a large surface, but the size of the picture may be increased, if the time of exposure is immaterial, by making use of smaller stops, even to the size of half an inch in diameter. At times, such an arrangement with the double lens is useful. A lens which covers six by five inches can thus be made to give a picture sharp to the edges eight by six inches, or even more. Reduced copies of oil paintings are advantageously made with a double lens and small stop.

Either a doublet, rectilinear, or aplanatic lens may be used for landscapes, and for copying still objects and works of art generally. They are furnished with revolving diaphragms or stops; when the object to be taken is well lighted, the smallest may be employed; but for masses of dark foliage, &c., the larger stop should be made use of. A little observation and exercise of judgment will soon determine the operator in the use of his stops. The rack and pinion movement to the portrait lens is desirable, as it can be readily reached with the hand, for the purpose of getting the sharpest focus. I consider that this addition to the landscape lens is unnecessary, owing to its greater focal length, which makes the rack and pinion movement inconvenient to use. A perfect focus can always be obtained with a well-made sliding camera. Portraits and groups can also be taken in the open air with the triplet, in a good light.

It may not be out of place to conclude with a few

general remarks worthy of consideration when absolutely perfect negatives are desired:—The sliding body of the camera should undoubtedly be lined with black cotton or silk velvet. I prefer the latter, the black dye of silk being more permanent. Landscape lenses, under very many circumstances, should be protected as much as possible from reflected light, entering the tube of brasswork, by means of a shade over the upper portion of the tube; this helps to prevent solarization of the sky. The shade need not project beyond four inches; a piece of brown paper and string answer the purpose.

To prove the necessity for this precaution, focus a landscape, withdraw the ground-glass, throw the velvet over your head, and look into the camera. A considerable quantity of light will be perceived on the lower surface of the lens tube; place a shade over the upper portion of the tube, and the extraneous light will vanish. All rays of light that do not actually emanate from the object to be copied ought to be dispensed with, when brilliancy of image is aimed at. It cannot be too frequently urged that the velvet cloth must be thrown over the slide when in position, before pulling up the shutter; and also that this should be large enough to extend somewhat over the rigid portion of the camera, in order to prevent light entering the sliding body.

I would remark, in conclusion, that experiments with ordinary double lenses of short focal length are, comparatively speaking, worthless for testing the actual value of photographic preparations or pro-

cesses; the results obtained on small plates are also not sufficiently conclusive. In order to arrive at a full and satisfactory conclusion, when working either for the purpose of chemical investigation in photography, or with a view of establishing the value of any process, plates not less than 10 by 8 inches should be used, and a single lens of ordinary focal length, with not more than half an inch aperture. I have for some time past adopted this course, and have found in every respect the indications more valuable and instructive.

I would say to all who appreciate this art for its great usefulness and numberless appliances, don't be contented with any but the best results: the practised eye soon gets accustomed to detect flaws and imperfections, arising in some instances from the use of bad tools. The connoisseur in photographic matters has now become fastidious, and ceases to admire a photograph for the interest attached to its wonderful production: apart from this, in the advanced and perfected state of the art, correct drawing and pleasing realizations of natural objects are looked for: and surely we may expect, that after twenty years and more of up-hill labour, this young giant of science will stride rapidly onwards, destined, even yet, to take a much higher position as an important and advancing art.

ON THE PREPARATION

OF A

NORMAL NITRATE OF SILVER BATH.

THE quantity of nitric acid wrapped up in the interstices of crystals of nitrate of silver varies very much, and, of course, according to the degree of acidity of the solution from which the crystals are formed. My attention has been given to this subject; during my investigations I have found a method of preparing a nitrate of silver bath in the normal state. The process is as follows:—It is assumed that all crystals of nitrate of silver contain, more or less, a small portion of nitric acid; fusing, to get rid of its presence, is a clumsy and objectionable method, for it is difficult to fuse nitrate of silver, even in very small quantities, with a view to perfectly driving off the free nitric acid (for which the crystals have a great attraction), without producing a new decomposition or contamination; the object, therefore, is to render inert this free nitric acid. The alkaline carbonates have been suggested: this method, to my mind, is very objectionable; in the first place, a new compound is introduced, carbonate of silver; secondly, if too much of the alkali be added, the strength of

the silver bath is impaired; it is also not unlikely that triple salts are formed. The most simple, and therefore the best plan, and one which I find answers invariably, is to add to the prepared silver bath a small quantity of freshly precipitated oxide of silver; the free nitric acid seizes upon this with avidity, and forms at once nitrate of silver (nitrate of silver being a nitrate of oxide of silver); it matters not whether just sufficient of this oxide be added or a large excess; if the latter, the strength of the bath is not impaired, the undissolved excess being simply left upon the filter. Having treated the bath in this way, it is in an alkaline state, and no picture can be taken with it; fortunately, however, its condition is perfectly normal, for the water which dissolves the crystals of nitrate of silver, dissolves also a specific and homœopathic dose of the oxide used, hence the alkaline re-action. It now becomes a nice point to act upon this atom of oxide with nitric acid: in the first place, the excess of undissolved oxide of silver must be separated by filtration, and to the bright filtered solution add $\frac{3}{4}$ths of a minim of nitric acid, sp. gr. 1·50, to 200 ozs. of the bath; this quantity is sufficient to correct the alkalinity produced by the presence of oxide of silver dissolved in the water of the bath, and at once, as if by magic, a most perfect picture can now be produced; the sensitiveness of the bath is ensured by the known quantity (being minute) of the acid added.

I consider that the presence of this acid, when it can be so nicely calculated as now described, is far

less objectionable than the excess of acetic acid sometimes used, this latter being more volatile, and the attraction for nitrate of silver not so strong. The bath, when acetic acid is added to correct the oxide, is liable to change from a possible liberation of this acid, due to a want of a powerful affinity for silver, which it fails to possess; whereas the nitric acid now recommended, however small the quantity present, is with difficulty got rid of. The object of this paper is, therefore, to establish these facts:— 1st, It is better to employ fine and pure crystals of nitrate of silver for preparing the bath; 2nd, To get rid of the excess of acid wrapped up in their interstices by adding to the solution sufficient, or an excess of oxide of silver; 3rd, That the bath so prepared is in a normal condition; 4th, To render it efficient and in working order, $\frac{2}{4}$ths of a minim of nitric acid, sp. gr. 1·50, must be added to every 200 ozs. of the filtered nitrate of silver bath to neutralise the oxide dissolved by the water; 5th, It is very evident that, having corrected the nitrate of silver bath with the oxide, the undissolved excess must be filtered away before adding the specified quantity of nitric acid; 6th, I consider that test-papers are not serviceable for indicating a delicately-balanced state of the nitrate of silver bath, in which case a developed plate gives the best indication of its condition. I would not, for a moment, be supposed to ignore the value of test-papers for showing the presence of either acid or alkali when present in a greater quantity than that now referred to.

In this paper, I make reference to nitric acid for correcting, sp. gr. 1·50. Acid of this strength is frequently met with in commerce; my object, therefore, in taking this acid as a standard of strength is sufficiently obvious; first, to show the exceedingly minute quantity necessary to produce the desired effect; and secondly, for the convenience to be derived from making reference to nitric acid of usual strength. It might, however, appear to many not desirous of taking the trouble to calculate fractions of a drop, that the correction required for 10 or 20 ozs. of the bath must be attended with some trouble. In order to meet this difficulty, I subjoin the following alkali and acid formula :—

THE ALKALI.

Oxide of Silver in a moist state.

THE DILUTE ACID.

Nitric acid 1·50	6 minims.
Distilled water	1 oz.

Treat the bath, as described, with the oxide of silver; filter from the excess, and add to each 20 ozs. of this filtered bath, five minims of the dilute nitric acid.*

* The nitrate of silver used for preparing a bath should be made with ingot silver and pure nitric acid, recrystalization is not then necessary.

FORMULA

FOR THE PREPARATION OF THE

NITRATE OF SILVER BATH.

INTO a 20 oz. stoppered bottle put

Nitrate of silver, 1¼ ounces,

Distilled water, 4 ounces—dissolve.

To this solution add

Iodide of potassium, 4 grains,

Dissolved in 1 drachm of distilled water.

Mix these two solutions; the precipitate (iodide of silver) thus formed is, by shaking, entirely dissolved. Add 16 ounces of distilled water, when the excess of iodide of silver is again thrown down, but in such a finely divided state as to render the saturation of the bath with iodide of silver perfect. Now drop in sufficient of the oxide of silver to turn the turbid yellow solution a dirty brown colour; so long as this effect is produced the quantity of oxide of silver, however much in excess, is of no consequence; shake the bottle well for ten minutes or so at intervals, then add alcohol, thirty minims, and filter; to the filtered solution add dilute nitric acid of the strength stated, 5 minims. The bath is now ready for use, and should be quite neutral.

NOTE.—The above formula has been given for the convenience and instruction of those who may have to obtain nitrate of silver that has not been specially

dried and freed from the excess of nitric acid for photographic purposes; but if the nitrate of silver be pulverized and dried at 212°, the free nitric acid being thereby driven off, the oxide of silver and acid may be admitted.

Formerly, when simple iodized collodion, potassium, or cadmium, was used only in the bath, the oxide of silver and acid could be employed with advantage, at times, as a corrective; but since the introduction of salts of ammonium into collodion, giving rise to the production, in the bath, of nitrate of ammonia, which dissolves oxide of silver, forming with it a triple compound, it has not been found desirable to use this preparation as a doctor for a disordered bath, the remedy in such a case being worse than the disease.

Photographers now generally agree that it is better to set aside a faulty bath rather than waste time in vain attempts at doctoring; but I cannot refrain from stating how, as I was informed, a perfect cure had been effected by a genius, whose perseverance was deserving of all praise, he having tried every known and unknown process with which he was acquainted, or found himself inspired with at the moment, at last, dashed into the refractory solution a lump of cyanide of potassium, an unknown quantity, and as a last resource, added two drachms of the strongest nitric acid to every pint of the solution!! This is merely inserted as a caution, and should be remembered as something to avoid: the perfect cure may be a matter of opinion.

OBSERVATIONS

IN REFERENCE TO THE STATE OF THE

NITRATE OF SILVER BATH,

AND ITS ACTION UPON

COLLODIONIZED PLATES.

THE ALKALINE NORMAL BATH, WHEN FILTERED FROM EXCESS OF OXIDE.—The plate when developed has a greyish colour, it is streaky, dirty, and greasy in appearance; the image shows through the film in parts very faintly: *i.e.*, it is only just discernible; the developer flows over the plate very easily.

THE BATH, WITH AN INSUFFICIENT QUANTITY OF NITRIC ACID AS A CORRECTIVE.—The plate when developed gives, at first, indications of a perfect picture, but with a suspicion of full exposure; the proper and gradual growth of intensity does not, however, take place; the half-tints in deepest shadow are rendered, and show simultaneously with the high lights; a flat, poor, and feeble image is the result; if the subject be landscape, the sky is faint, transparent, and streaky; the exposure in the camera may have been very short, and under this condition of the bath, perhaps half the legitimate exposure gives the result described.

THE BATH, WITH A PROPER QUANTITY OF NITRIC ACID AS A CORRECTIVE.—The image springs out shortly after the developer is poured on; first, of a well-defined metallic grey colour, the highest lights being from the first well defined; the growth of middle tints next becomes discernible; the parts in deepest shadow show next in rotation, the whole picture being evident before increase of intensity takes place; this now goes on gradually until an unmistakeable harmony pervades the whole; the brilliancy of the picture is well preserved, and no sign of fogging exists. If the exposure has been well timed, there is not much fear of over-development. The intensity of sky is good, and uniformly opaque: when viewed by reflected light, the negative whilst wet presents a soft and partly positive appearance; when dry, this image is more difficult to see, but it should not be too clouded.

THE BATH, WITH AN EXCESS OF NITRIC ACID.—The image appears in parts of the plate only, and that with great difficulty; the black deposit is very transparent; it is altogether most evident that the deoxidiser acts inefficiently, the decomposition of the nitrate of silver being checked by the presence of nitric acid in excess. Under these circumstances no amount of exposure in the camera compensates for acidity of the bath; the developer flows with difficulty over the plate.

THE BATH UNDER SOME CIRCUMSTANCES REQUIRES THE ADDITION OF AN ACID.—The indications are, of course, those stated in the second paragraph. In

hot weather it is very desirable to add a few drops of the dilute acid to every half-gallon of the bath. I find, also, that when testing and experimenting with collodion *just iodized*, after immersing a dozen plates, a slight alkalinity is evident—to an extent not absolutely injurious—but nevertheless discernible by a falling off in brilliancy of the negative; add a drop of the dilute nitric acid, and all again goes well. No alkalinity is discernible when collodion a day old is employed.

NOTE.—These observations refer to the use of iron as a developer. Using simple iodized collodion developed with pyrogallic acid, the image springs out first of a reddish brown colour, rapidly passing on to black.

DIRECTIONS

FOR

CLEANING THE GLASS PLATE.

It is not at all an uncommon thing to hear that collodion gives spots, stains, streaks, and sundry other cutaneous affections to which "the children of the sun" are said to be peculiarly liable; very much, however, is erroneously attributed to the collodion, which, more properly and with greater justice, should be ascribed to want of cleanliness and method in cleaning the plate. Nothing is so easy; and although there are many ways of arriving at this very desirable end, I unhesitatingly recommend the following as most efficient, safe, and simple. Cleaning the plate is of much greater consequence than some are prepared to admit. Every photographer should make himself thoroughly acquainted with this process; much time, expense, and subsequent labour will be saved by a systematic attention to what may at first be thought sheer drudgery, and which is too often delegated to inexperienced and careless hands. I am not saying too much when I state that, in point of manipulation, cleaning the plate is the key to the whole position. I now proceed to describe, for the

benefit of those who can fit up their operating-room with conveniences, the plan I adopt.

I have a shallow sink, three inches deep, lined with lead, and a pipe to convey away the waste water (the size of this sink must, of course, be regulated by the size of the plates to be cleaned); it is firmly mounted on a stand of convenient height, and securely fixed to the wall of the room; in this sink I place two blocks of deal ($1\frac{1}{2}$ inch stuff) a little larger than the plate, covered with thick felt strained over one side of the block and nailed to the edges all round; over this, in the same manner, I strain white calico; the blocks are now prepared, and present a firm but sufficiently soft surface, on which to cleanse the plates; place them in the sink and wedge up tight with loose wedges. I use one of these blocks for the first operation. Place the plate to be cleaned in the centre of the block, and pour on to it a small quantity of the following mixture:—

Prepared tripoli	2 ozs.
Water	$3\frac{1}{2}$ „
Spirits of wine	4 „
Solution of ammonia	$\frac{1}{2}$ „

Take a tuft of cotton-wool and rub the plate well and firmly over with the above mixture for a minute or so; then remove the plate to block No. 2 (over this I have fixed a tap of water, a few inches above the plate); turn on a gentle stream and rub off the tripoli mixture with a second tuft of cotton-wool. Keep these tufts upon their respective blocks; they

are then always ready for use. Be very careful to rub the edges of the glass with the tuft, to remove particles of tripoli which become attached to the roughened edge, and which, if not removed, will give a prolific crop of spots on the picture. Having washed off the tripoli, plunge the plate into a deep dish of water, and there let it remain until six plates or more have been in like manner cleaned: then take each out singly, again wiping the edges with a tuft of cotton, and pass each plate through a dish of distilled water. Do not set up more than six at a time to drain; when six have thus been treated, commence drying off the first set up. The plates must not be allowed to become dry before rubbing with the cloths. In order to dry them quickly and effectively, place upon the table a piece of felt or ironing-blanket, over which spread one of the cloths (washed in clean water without soap); place the plate upon this, and rub it well on both sides with another cloth doubled up so as to form a pad. One side of this plate should be marked with a diamond, and upon this marked side the greatest care should be bestowed. The plates, so far cleaned, may be stowed away in a box; before use, however, the final rub must be given, to remove all superfluous moisture; this is best effected by two wash-leathers, previously purified by washing and rinsing them freely in water, for two days or so; they must be allowed to dry spontaneously. Lay the plate upon one of these leathers, and rub it well on both sides with the other leather doubled up so as to form a pad. Breathe

occasionally upon the plate whilst rubbing; this tends to equalize the moisture. Rub, lastly, with a well-washed silk handkerchief. Even now, some small particles of fibre may be left from the cloths, and these attach themselves very tenaciously to the glass; in order, therefore, to remove these enemies to an absolute pure plate free from "comets," I take a flat and broad camel-hair brush three inches wide, and pass it firmly over the plate just before pouring on the collodion. This brush must be most carefully prepared for the purpose, by soaking it in water for two or three days, and rubbing out all dust and extraneous matter with the fingers; it must then be suffered to dry spontaneously, and kept free from dust in a card-board box; if this cleansing be neglected, more impurities will be added to the plate than removed from it.

I have been at some pains to describe clearly a systematic method of plate-cleaning, feeling certain that the necessity for carefulness in this process is not sufficiently attended to. I am sure that nearly all "comets" and other abominations arise from the imperfect removal of fluff and fibre from the plate. These minute particles are not seen until draining off the collodion: they then show themselves in the form of nuclei, checking the collodion in its course, and, what is very much to be avoided, they contaminate the collodion, which becomes full of floating particles, and thus prevents the possibility of getting clean plates, until the collodion has again been allowed to settle; if, therefore, it is required to make

experiments only, without regard to the purity of the result, keep a bottle of collodion for this purpose.

When working at home with all the conveniences described at hand, plates used (if the picture is not approved of) may be at once placed in a dish of water; the film then floats off and carries with it all impurities; rubbing with plain tripoli and water and drying as described, will then be found sufficient. New plates must always be put through the whole process, and also those which have become dry with films on.

A perfectly clean glass shows little or no irregularity on the surface when breathed upon, having then very much the appearance of ground glass, and, if properly dried, the moisture flies off rapidly. Collodion flows easily and freely over a well-cleaned and dry plate, presenting a surface free from irregularities, either before or after the action of the nitrate of silver bath.

The practice of cleaning glass plates with detergents, said not to require subsequent washing, is one fraught with great risk and full of objection; it is impossible to get rid of fixed alkalies or salts, by mere friction with a cloth, without washing. I allude to this method of cleaning (?) because I know that it has been the cause of much trouble to many who have for a time adopted the plan; moreover, it is *by such a process* impossible to remove the tripoli, or rouge, the base of some of these nostrums, from the ground edges of the glass.

HOW TO
VARNISH THE NEGATIVE.

THIS subject is deserving of careful attention; at the same time, all that can or need be said concerning it, may be stated very plainly and in a few words.

I will endeavour to explain and comment upon the two methods now in use, and will distinguish them by the terms "hot" and "cold." I apply the first term, hot, to the process making the warming of the plate necessary previous to pouring on the varnish, which is applied whilst the plate is still warm. This method is very generally followed, notwithstanding the inconvenience of heating the plate—for the reason that the coating left upon the surface is perhaps harder than when cold varnish is applied, and consequently stands a greater amount of rough treatment: no doubt a desideratum. Ordinary spirit varnish, whether French or English, contains a certain amount of water; that is to say, the spirit generally used is not absolute. A more fluid, and consequently a better varnish, can, I think, be made with absolute alcohol—at least, such is the result of my experiments; but whatever strength of spirit is used, the effect of all spirit varnishes, more or less, is to interpose between the image on the surface of the

negative, and the prepared surface of the paper, a layer of gum more or less thick. I need hardly say that any intermediate film must prevent absolute contact of these surfaces, and consequently detract somewhat from the sharpness of the picture.

There can be no very great mystery as to the composition of spirit varnishes, when it is considered that the gums we have to select from are not numerous, viz., copal, animi, sandarac, thus, mastic, lac, dammar, &c.; these gum resins have, however, various properties, some being harder and more vitreous than the others, whilst some are sticky and resinous. It is, therefore, very desirable to make use of both these qualities, by selecting and combining judiciously such of the gums, just enumerated, as shall give a varnish, possessing hardness and durability, with sufficient elasticity. The hardest gum cannot be used alone, but must be mixed with others more resinous. I have heard it remarked that some varnishes, occasionally, have a very unhappy property of removing the image from the negative. This action is entirely due to the condition of the film of collodion, brought about, either by its having been kept too long iodized, or by the use of an unsuitable pyroxyline in its manufacture.

To apply the spirit varnish, first hold the back of the plate, out of a draught, before a clear bright fire, until warm enough to be uncomfortable when tested with the back of the hand; show the front to the fire for a few seconds previous to pouring on the varnish; when this has been done, and the surface set,

again warm the plate. If a lamp, oil or spirit, be used for heating the plate, it should be held at some distance from the flame and kept moving until the desired heat is obtained.

The advantage and disadvantages in the use of spirit varnish may be briefly stated: in its favour, a greater hardness of coating; against it, the inconvenience of having to heat the plate, and loss of sharpness in the positive from the interposed film of gums left upon the surface of the negative. Having disposed of what I have termed the hot process, it only remains to draw attention to that designated "cold." It is not my intention to enumerate the various solvents and gums which are or which might be used for the manufacture of cold varnishes. I have tried many of them, and find that all are, more or less, tacky when dry.

I shall confine myself to a few words descriptive of the best cold varnish, which, unquestionably, is that made by dissolving amber in chloroform. Many will be surprised to hear that such a thing as a package of fine amber seldom, if ever, finds its way to this country; but plenty of a very inferior and rough description is to be met with. The finest kind is used for making the mouthpieces of pipes. Having learnt this much, I set to work to obtain, through the merchants, some information on the subject, and was fortunate to find out the holder of a large quantity of the chippings from the fine pieces of amber which he had been provident enough to store away. This is not a coarse powder of amber,

but unmistakeable chippings cut as with a sharp instrument, bright and clear in quality, in every respect equal, for making varnish, to the fine and most costly pieces, of which, indeed, these chippings are a portion. With such a sample as this there is no difficulty in producing a varnish in every respect desirable for photographic use, and sufficiently hard to withstand any friction that the surface of a negative is likely to meet with, when only a moderate number of copies are required. The coating left upon the negative is perfect, and can hardly be distinguished from the patent plate: this varnish penetrates the film, and adds very much to the beauty and clearness of the negative, at the same time leaving upon the film the thinnest possible coating, thus admitting of the most perfect contact with the excited paper.

I have had opportunities of examining some hundreds of negatives, produced by various operators, both amateur and professional, many of which were more or less disfigured, if not damaged, by the varnishing operation. My method of using the amber varnish is as follows:—I invariably make use of a little distilled water, with which I wash finally the finished negative; this removes the salts of lime that exist, more or less with other impurities, in all waters, in quantities quite sufficient to prevent the formation of a brilliant surface. I consider this simple but cleanly operation one of the important photographic "insect cares." Now set the negative up to drain and dry spontaneously, its face to the

wall, and its lower part resting upon a slip of clean bibulous paper; it is as well to change this slip of paper once or twice: when surface-dry, the negatives may be put into a grooved box to keep them from dust, and, if more convenient, they may be varnished next day. All varnishes should be applied in a dry room.* Attach the back of the negative to a pneumatic holder kept for the purpose, and having poured into a glass measure more of the varnish than is required to cover the plate, proceed to pour on as much as the plate will hold; keep the plate as horizontal as possible, and let the varnish soak well in for twenty or thirty seconds; then gently raise the plate, and pour back the excess into the measure, from the nearest right hand corner. The varnish must not be dashed off, but the plate very gently elevated, at first only just out of the horizontal, and very gradually raised until it stands vertically on the edge of the measure; in this position let it remain a few seconds; on no account rock or give it any eccentric motion, and during the whole operation hold the breath, or turn the head away to breathe.

Always have two bottles for varnishing—the one to contain the stock of bright filtered varnish, the other to receive the portion poured back into the measure from the plate; when sufficient has been collected in this bottle, filter it through paper into the bright stock bottle. Both amber and spirit var-

* Just before varnishing, when amber varnish is used, pass the back of the plate over the flame of a lamp to drive off any moisture; allow the plate to cool before pouring on the varnish.

nishes filter rapidly and with a very slight loss. The measure used should not be washed out, but kept turned down and free from dust; it is then always ready for the purpose required.

I possess a negative portrait of Sir John Herschel, taken about fifteen years ago, which I value very much. This plate was varnished with some varnish made of very fine amber; it does not show the slightest sign of decay; is, indeed, harder than when first varnished. I have also negatives kept under various circumstances of damp and heat for fifteen years, and still perfect.

I have occasionally been asked to account for cracks in negatives; they may arise from the method of drying the negative, imperfect washing out of the hyposulphite or cyanide, or from the mode of drying the plate before varnishing.* The lengthened operations *sometimes* necessary in developing, and more particularly in intensifying, tend to loosen the film from the glass, with which there is, in reality, no bond of union, but only a state of imperfect adhesion. A subsequent imprisonment by the varnish and unequal contraction and expansion of the two films may, I think, account for the cracks in negatives, of late years only too well known to photographers. I

* Negatives should not be kept in damp and cold rooms; no matter how carefully they may have been washed and dried, or how good the varnish may be, if exposed to frost and moisture, symptoms of cracks will be soon evident. I have known instances of negatives becoming cracked in the film, from exposure in the printing-frame for some hours on wet and cold days in winter.

have before said that negatives should be allowed to dry *spontaneously*. It is of the utmost consequence, as regards the permanency of the negative, that the fixing agent should be thoroughly removed; also, that the heat required to warm the plate, before varnishing, should be applied in a regular manner, and only just sufficient to accomplish the object in view. Now, with reference to the first point, I say, let the film dry spontaneously, because there may be some conditions of a collodion film, presenting a proneness to split up on the sudden and irregular application of heat to it, whilst still in a wet state. Recollect that the edges of the glass plate are usually ground; this restrains a natural tendency of the film to contract after removal of the iodide of silver by the fixing agent; the film is therefore more or less in a state of tension, being extended, so to speak, by the ground edges of the glass. The simple operation of passing a cloth (the thumb-nail being inserted) round the edges of the negative, to the distance of one-eighth of an inch, sets the film free, removes the thick dirty edge of the negative, and is a safeguard against injury arising from continued tension of the film; moreover, it adds to the neat appearance of the negative, and admits of the film being overlapped with the varnish—an additional advantage. The reason for scrupulous attention to my second point is sufficiently obvious: a slight trace of cyanide or hyposulphite might not show itself at first—sooner or later this wrapped-up element of decay will begin to make itself known, and brings about a disintegra-

tion of the film. An impression has got abroad that cyanide of potassium requires for its removal less washing than the hyposulphite of soda. I think this is erroneous. My opinion is that the former salt should be as well washed out as the latter, and to effect this I believe that quite as much water is necessary. The collodion film has a very retentive action on most chemical solutions presented to it. I do not see why it should be less an absorbent of the cyanide than the cuticle of the body. I take this as a familar illustration, because most people must have observed that when the fingers have been cleaned with cyanide of potassium, the peculiarly disagreeable odour remains for a time, even after the most perfect ablution. Lastly, the instructions already given sufficiently explain the manner of warming a negative previous to varnishing.

In order to secure a brilliant varnished surface, thorough washing of the negative is absolutely necessary, particularly between the operations of developing with iron, and intensifying with pyrogallic; if this be neglected the varnish sometimes acts as a capital tell-tale, entering the film and clouding the image by a precipitation of the impurities hidden therein. At times, however, it may be necessary to coat twice with the varnish, for a collodion film may be in a state, not absolutely soluble in the alcohol, but so near this condition as to admit of a too familiar union with the varnish, and so cause a want of brilliancy. A negative may be varnished first with amber varnish, and subsequently, if many proofs are required, with the spirit varnish.

Varnishes will be selected by the photographic artist for qualities specially adapted to photographic use, viz.. facility of application, hardness of film, and absence of tackiness. These conditions are well fulfilled in the preparations spoken of in my paper, "How to varnish the negative."

HOW TO

PRINT FROM THE NEGATIVE.

In order to print from the negative, very little skill in manipulation is necessary; but very much judgment and taste must be exercised in order to produce the best results, if really good proofs are cared for. Many look upon the operation of printing as mere drudgery—beneath notice; this work is frequently handed over to the care of boys and girls, who have as much feeling for art as the pressure-frame used to produce the picture. Having a first-rate negative, it is quite possible to obtain from it proofs of various qualities; so that, it may be, there are not two alike in a dozen prints, and perhaps one of them will be found superior to the other eleven. I admit that a difficulty exists, and one not easily removed; it lies solely in the variability of sunlight in this climate. At first sight it would appear easy enough to obviate this by a watchful examination of the picture whilst printing: such a course gives a proximate notion only of the real state of the print; for, presuming the day be dull, and occasional glimpses of sunshine flit over the printing-frame, it will be found impossible to calculate to a degree the amount of reduction that will take place in fixing the picture. If ex-

posed for some time on a dull day without sun, the positive may appear to be very much overdone, and yet be too much acted upon whilst undergoing the necessary immersion in the bath of hyposulphite of of soda, *in consequence of the greater reducing power of this salt on proofs printed in feeble light.*

I am, of course, taking it for granted that there is a shade of intensity to be sought for in the positive picture, which the negative is capable of giving, and which shade shall be acknowledged to be that best suited to the particular subject represented. For the reasons just stated, it will be found difficult to obtain this quality at will with a variable sunlight. The natural deduction to be drawn from these remarks, therefore, is, that in order to produce from a negative several copies uniform in quality, it is necessary to print in direct sunlight; one or two experiments will then show the character of the negative; the time required to print from it, in order to obtain a special intensity of tone, can be easily noted. I do not now refer to colour; but, by intensity of tone, I mean that amount of force giving artistically the best result from a particular negative; and this leads me to another remark, viz., the quality of the negative; for, supposing the same collodion to have been used for the production of a series of negatives of different subjects, the printing peculiarities of each negative will vary, according to the subject represented, the colour of which, and quality of the light used to produce the negative, affect its resisting power to stop out rays of transmitted light. It is, therefore,

necessary to be acquainted with the peculiarities of each negative. There is this advantage in printing in direct sunlight—the subsequent reduction can be calculated to a nicety, whether the negative be faint or vigorous: for, as I have before stated, the positive produced under these circumstances does not suffer such an excessive and variable reduction in the hyposulphite of soda, as when a bad or variable light is used. I am, of course, aware that some sort of compromise may be effected by very much over-printing, and then reducing the excess of intensity by a prolonged immersion in the hyposulphite of soda bath. I am by no means satisfied with this plan; the picture then is not of first-rate quality, but hard and inferior in tone, and seldom brilliant. Of course, in allowing for the over-printing, it is necessary to lay down a given time for fixing in hyposulphite of soda; I put this at half an hour, and never fix more than a few proofs in a dish at a time, taking care that they do not come too much in contact, and turning them over constantly. Now it can be very readily demonstrated that positives printed in a bad light are much more rapidly acted upon by the hyposulphite of soda, as I have before said; nothing, therefore, seems so easy of confirmation as this proposition, that in proportion to the acting power of the hyposulphite of soda upon the reduced silver, so will be the action of other external influences of a chemical nature on the picture when finished. To my mind this appears only a plain, common-sense view of the case, and the inference to be drawn,

therefore, is, that a greater general permanency is obtained by printing in direct sunlight. These observations may open up a new field of inquiry, and may, perhaps, account for the variableness in the permanency of photographic pictures. All good negatives should stand sunlight printing; I am certain that a finer definition of detail is obtained, and both a greater richness and brilliancy of colour, when prints are made under these circumstances.

I may as well remark here, that a very faint negative will, under no conditions of light, give a fine, rich, and dark-coloured positive; the picture may certainly be cooked in baths of gold, and much variety of smudginess produced—a dead, cold, and leaden hue—shades of black fit only to represent scenes in pandemonium. This is the character of colour forced upon faint positives by over-dosing with gold. A well-printed positive of good vigorous colour will stand a longer immersion in the gold bath, and yet be free from the objectionable colour just described. There is considerable room for display of taste in the selection of shades and tones of colour in photographs, according to the subject represented; the most infelicitous choice is sometimes made. I think that a great deal of the evil is to be attributed to the wholesale and reckless use of gold, which, if skilfully used, is capable of producing every variety of good photographic colour.

I once heard of an amateur who apologized to his friend for the bad colour of a photograph he was anxious to present him with, at the same time saying,

somewhat mournfully, "he had expended on it the contents of a 15-grain bottle of gold;" but even then it fell short of some ideal standard of perfection. The doctrine of sunlight printing which I have endeavoured to lay down would, of course, be fatal to general photographic business in this country; it would never do to be waiting upon and otherwise dodging our great luminary; the principle involved, however, may nevertheless be true, although its practice may be difficult or perhaps impossible. I am now addressing the few who, like myself, are anxious to produce at will a first-rate impression from a negative of good quality.

There are several good toning processes; I prefer the simple Alkaline Chloride of Gold Process, to which a preference is also given by some of our most successful photographers. Albuminized paper, either saxe or rive, may be used; with the latter a darker colour is obtainable. Float each piece of paper for three minutes upon a solution of nitrate of silver, 60 grains to 1 ounce of distilled water, and use it as soon as it is quite dry. I have observed that a brighter colour is obtained, when the paper is used very soon after excitation; let the paper, however, be quite dry before using it; expose in the frame in the usual way. I prefer, for my own use, the bars of pressure frames fitted with screws—the contact may then be made so perfect all over; but spring-back pressure-frames are generally used by photographers, and they can now be obtained of excellent quality. In sunlight the time of exposure will vary from ten

minutes (the minimum time) to half an hour for ordinary subjects: but a much longer exposure will be necessary for the representation of black and white subjects, such as engravings. Be very careful to examine the print *in yellow light,* whilst printing; if the frame be opened, even for a few seconds, in sunlight, a slight general action of light will take place over the whole surface of the picture. *Conduct the operations of toning and fixing in yellow light.* When the print has reached the proper intensity (allowing for the reduction), remove it from the printing-frame, and wash away in several changes of common water all the nitrate of silver; when this has been properly effected, prepare the following bath, which will be ready for use an hour after mixing:—

Solution of bicarbonate of soda, 40 minims.
(Strength, 8 grains to 1 oz. of distilled water.)
Solution of chloride of gold, 20 minims.
(Strength, 15 grains to 5 drachms of distilled water.)
Distilled water, 4 ozs.—Mix.

The solutions both of gold and soda may be kept ready for use in separate bottles. I throw away the colouring bath after use, or it may be set aside for the purpose of recovering the gold, when a sufficient quantity has been accumulated. The above quantity will tone half a dozen pictures 10 × 8, if warm tones only are required; the time of immersion varies from thirty seconds to two minutes. Over-colour the positives slightly, to allow for subsequent reduction

in the hyposulphite of soda bath. Now wash away the excess of gold solution rapidly in two or three changes of water, and fix the proofs in a bath of hyposulphite of soda, 1 oz. to 6 ozs. of water.* In order to make sure of the pictures being perfectly fixed, let the proofs remain in this bath half an hour —not less, moving them about occasionally; then wash in running water for twelve hours, and let them dry spontaneously. I have a strong feeling in favour of a particular colour for photographs; no word-painting will describe this or any other tone of colour. It is something half way between brown and purple. It is very evident that paper treated and washed as just described, involving an immersion of twelve hours in liquids, must have undergone some alteration in the arrangement of its atoms; these are now, of course, more open, spongy, and porous, consequently the particles of silver forming the image must of necessity be somewhat divided and less compact than is desirable,—I think, therefore, more in a condition to absorb deleterious gases, and more susceptible of damage from moisture in the atmosphere or other injurious influences. It is most desirable to restore the paper to its original condition; this is easily done at a very small charge by the hot-presser. The pictures must not be over-rolled—such an action would be injurious to the surface. I order mine to be rolled flat only; this

* If the plan be adopted of fixing the pictures singly, 1 oz. of hyposulphite of soda to 4 ozs. of water may be used, and the immersion then need not be more than fifteen minutes.

last operation is, I consider, most beneficial, both as regards the beauty and permanency of the finished photograph.

As a rule, printing is now generally performed in the shade by all professional photographers, this plan being found, in *commercial* practice, to give the most uniform results, and admitting of a greater latitude in the time of exposure in the printing-frame; but notwithstanding this, the principle I have endeavourred to enunciate, applies with equal force and truth to the production of prints from any kind of negative whatever; although, as I have before stated, printing by sunlight could not be carried out with any chance of commercial success.*

* Various formulæ for colouring baths will be found in the Appendix.

THE CAUSE OF

FOG, STAINS, AND STREAKS

IN THE

COLLODION NEGATIVE.

FOGGING of the plate or a general haziness of the image, may be due to several causes; it may be produced by the action of light in the camera. All things considered, is it not wonderful that we have a clear image in a latent state upon the highly sensitive surface of the collodion plate? Light passes equally into the darkened box through the full aperture of the lens; but at the focus of the lens it is also deposited, so to speak, in a ratio equal to the reflecting power of the surfaces of the objects to be copied, impressing the first atoms of the sensitive film in a degree equal to the amount of light reflected from such surfaces. It will be readily granted and very easily conceived, how soon a disturbing influence may be brought about by the introduction of any false light in the camera wherein this image is produced; but notwithstanding this incontrovertible fact, there are those who remain careless as to the manner of rendering the camera absolutely dark, inattention to which prevents brilliancy of the image, producing what is

termed fog. The indistinctness referred to may also be produced by sensitizing and developing the plate in a room lighted either by means of light, improper in quality, or by using too much of this light. What, therefore, is the character and amount of light that can be safely used in the operating room? In reply to this inquiry there is fortunately a very clear answer. Let me state it. And first I wish to lay down as a rule, that with properly prepared collodion, no matter what the light out-of-doors be, the negative image, whether under-exposed, or just enough exposed, should more or less, on some portions, and generally of course on those parts in deepest shadow, show a bright positive surface when developed and fixed. Too much light in the operating room will destroy this brilliancy. Another guide is the behaviour of the developer. The developer should remain bright for some time; too much light in the room will cause it to blacken, and in some cases throw down a loose black deposit at a very early stage of the development. I recommend every one to adopt the course I am now going to suggest. Darken the room entirely, so that no object be discernible; slits, crevices, and holes will then be seen. Now let light into the room, passed through a piece of double-flashed deep orange-coloured glass, covered with a screen of orange coloured paper.* For the purpose of experiment only, let this aperture of yellow light be as small as possible: under these inconvenient

* Paper similar in quality to that used for the cover of the *Cornhill Magazine* answers admirably.

conditions of light, develop a picture, and note well its character; then find out by degrees how much larger the aperture of yellow light may be made, so that the beauty and purity of the picture be not less on comparison with the first result, obtained almost in darkness, and which may be called, the test-plate. It will then be very soon ascertained how large the aperture of yellow light may be made with safety. Let it be, however, remembered that this experiment must be performed on a bright day, when the light is strongest upon the covered orange-coloured glass. I do not believe that either stained glass, dyed stuffs, or paper *alone* can be depended on; the perfection of a yellow light for photographic purposes will be found in a combination of two of these substances. The number of superficial square inches of light, passing through this medium, must be regulated according to the position of the window through which the light passes; hence the necessity for these experiments, and the difficulty in laying down any fixed rules. This is my formula for lighting a room with yellow light; but bear in mind that the want of a perfectly light-tight cover to the bath for use, whilst the plate is iodizing, would be equally a source of stains and fogging; therefore, in making the *test* experiment, cover the bath and its case entirely over with black velvet or some other dark material, should there be occasion to open the door during the preparation of the plate. The window of the room should also be fitted with a moveable shade of yellow material, in case the sun's rays should, at some hour of the day,

fall too strongly upon it. An extensive correspondence confirms me in the opinion that many suffer from a want of knowledge of the deleterious action of light, under the circumstances stated.

Again, the collodion may be the cause of fog. The absorption of iodine that takes place, more or less, in collodion containing a bromide, renders it too neutral, frequently giving rise to a haziness of the image, and consequently, an impression that the nitrate of silver bath is out of order is frequently conveyed, when such is really not the case.

When collodion becomes colourless or lighter in colour, after having been kept a few days iodized, a solution of iodine in spirit should be added, in quantity just sufficient to restore the pale amber colour which it possessed when freshly iodized.

A bright picture is always obtainable with properly prepared collodion, *when used of the proper colour*, according to these instructions; it therefore follows that when fogging occurs it must be due either to the deteriorated state of the bath, or to causes stated in this paper, viz., improper lighting of the subject, or to extraneous light either impinging on the lens, or entering the operating room in improper quality and quantity.

An under-exposed picture is the best test for the condition of the chemicals (*i.e.*, as to freedom from fog). The image in parts, when under-exposed, should be, when viewed by transmitted light, as clear and bright as the glass, and more or less positive by reflected light. No more iodine should be added to

collodion than is necessary to produce this result. The addition of acid to the bath should be avoided, as this tends to impair the quality of the negative, lessening sensitiveness and density.

The atom of iodine recommended, develops nitric acid, and ensures its presence in proper quantity, and moreover in the proper place, being first liberated in the body of the film of collodion, thus giving the greatest amount of brilliancy combined with the maximum of sensitiveness.

Formula for solution of iodine:—

Iodine ..... 2 grains.
Spirits of wine ..... 1 drachm.

One drop added to each ounce of iodized collodion will be found to produce the desired effect.

It may sometimes be necessary, after a few days, to repeat the dose.

N.B.—The above remarks apply also to collodion sold iodized, which, if colourless, should be rendered pale yellow by the addition of solution of iodine as above directed.

Glass may be viewed as a chemical compound, the silica of which it is composed, combines with the alkaline bases, soda and potash, in definite proportions. Like other chemical bodies it is affected by atmospheric influences—the harder the glass the less it is altered by moisture and chemical agents, a soda glass being preferable to that made with potash. Although silica unites definitely and in equivalent proportions with the alkaline base, a variable quan-

tity of the basic oxide is found to exist in most glass, hence the difference in hardness and hygrometric properties. Bearing these facts in mind, it is easy to understand the necessity for attention to the condition, not only of the surfaces, but also of the body of the glass at the time it receives the collodion solution: to ensure a dry condition it must be well rubbed in winter, on both sides, with dry or warm cloths. I find nothing better than the mixture recommended in this Treatise for obtaining a clean and uniform surface. I can always produce a faultless negative when the plate has gone through the process referred to.

Now it will be very easily seen how moisture operates in producing streaky or stainy pictures: if the operator adds a drop or so of his collodion to a small quantity of water in a measure, the incompatibility of the two fluids is very evident, and no amount of agitation will produce solution or mixture.

It is, however, quite true that a drop or two of water added to collodion, becomes taken up by shaking; in the case of the moist plate we have an illustration of the first example, viz., the collodion to the moisture; or if it be thought that the excess of collodion in this case favours the absorption of moisture presented to it, as in the second example, recollect that the operations are not analogous, for the necessary agitation is wanting, and hence a cause of the streaky and smeary appearance, resulting from the contact of bodies having no affinity for each other. The effect of moisture, or water, when brought

into contact with collodion, is to precipitate the pyroxyline held in solution. A streaky condition of the plate is thus produced, and in consequence, these parts absorb the nitrate of silver unequally.

Secondly, a too rapid immersion of the plate will produce a similar result. In winter or in damp weather the film does not set rapidly, a few seconds should then be allowed to elapse before immersing the plate; when the thermometer is at about 60° the plate may be placed in the bath soon after the collodion ceases to run, without any fear of producing streaks; perform this operation leisurely and watch the appearance of the film at that corner nearest the bottle.

Thirdly, an excessive accumulation of ether and alcohol in the bath. The bath in time becomes contaminated with ether and alcohol (ether being only miscible with water in a certain proportion) especially so in winter, the ether and alcohol in damp and cold weather not leaving the film so freely. The excess of ether floats on the surface of the bath in a greasy condition, combined with some organic matter from the film: this impurity is not readily separated by filtering the bath through paper, the greater portion passing through the filter; it may, to a certain extent, be got rid of, by lightly passing a slip of filtering paper over the surface of the bath, by which the greasy matter is absorbed. This plan is, however, troublesome and requires repetition; exposure of the bath for some days, in a wide-mouth bottle, to light and heat, shaking up with it at the same time a

little carbonate of soda, will frequently again render the bath workable.

A better plan is, to make use of a stoppered glass bottle with a glass tap inserted about an inch or so from the bottom, by means of which the intermediate bright solution is drawn off for use, and all floating matter avoided; this arrangement has the further advantage of leaving all particles of detached pieces of film and iodide at the bottom of the vessel, and does away with the inconvenience of having to filter the bath so frequently. The bottles here described can be procured to hold from four to sixteen pints, and are most useful for all chemical solutions.

Fourthly, from floating particles of film and iodide in the bath which having been acted upon by light are in a catalytic condition, and, becoming attached to the film, assist in intensifying the action along the stream of liquid flowing from this nucleus. In these suggestions I think will be found means for overcoming and providing against streaks: there is, however, another enemy to absolutely clean and perfect plates—I allude to the innumerable varieties of spots, met with more or less at times by even the most accomplished photographers. I do not think that these arise frequently from dust; I have worked occasionally in a most dusty room, and still dustier camera, without a speck on the negative. Presuming that the collodion be of good quality, my own experience in this matter points to one special cause, and one only, providing the remarks on this subject in my paper, "How to Clean the Glass Plate," be

borne in mind; they arise chiefly from the breaking or rather grinding up of the film of iodide, by means of the stopper inserted into the neck of the bottle, after the preparation of the plate; the film is not easily removed by wiping, for this act often fails to remove the dried film, a portion of which becomes only displaced and falls undissolved into the collodion. The remedy at once suggests itself—work without a stopper; this may be easily done at home, but not so out of doors; for home use, a bottle with a cap only, can be used, but the bottle should be provided also with a stopper to insert after work, the neck to be wiped clean before replacing it. When working out of doors, perfectly clean pictures can always be ensured, by first pouring away a few drops of the collodion, and then proceeding at once to coat the plate; this latter plan can also be adopted with advantage, even when the capped and stopperless bottle is employed.

ON THE
PERMANENCY OF SILVER PRINTS.

THE time has now arrived when every one, who has anything to say in reference to the permanence of photographic prints, or still more, has any experience to give in relation to this subject, should at once speak out. I firmly believe that an oppressive weight has overhung the labours of photographers; it is as if they toiled under a foregone conclusion, not that all that's bright must fade, but that a photograph must *of necessity* depart, long before the appointed time of all terrestrial matter.

This dreadful bugbear has been brought about by, first, in the early days of the art, an excusable ignorance, and consequently a wide circulation of the most perishable article now manifesting itself; secondly, by an increased demand on the powers of the photographer to supply a largely increased number of proofs at a low and barely remunerative price, this absorbing all his attention for the moment; and thirdly, a following of custom and a want of stepping out from a beaten to a more original and philosophical track; and not these things alone have photographers had to contend with, but still more, a powerful and constant battery of no mean periodical

literature, devoted to the art, has, I believe conscientiously, been brought to bear on the instability of that which I, for one, still believe to be, under circumstances, a stable thing. With all these disadvantages how any art could have held its own for so many years, is as great a marvel as is the art itself; but this only shows the strong vitality by which it is impelled onwards.

It will be well to consider this subject carefully, and for the purpose of being concise I propose viewing it under three aspects; first, what has been done; what it is proposed to do; and what appears to me, from observation and experience, should be done for the preservation of photographs.

A few paragraphs will be sufficient for the purpose of showing what has been done. It has become generally understood that the use of a separate colouring bath tends to the preservation of the photograph, and that fresh hyposulphite of soda solutions are necessary for effecting this end; also that copious washing of the finished print with a plentiful supply of water, kept moving, is absolutely necessary. Formerly, strange mixtures, under the name of "Old Hypo," &c., were used for the purpose of producing the so-called "velvety-blacks," and, indeed, the more homely and every-day tints owed their appearance to subtle chemical compounds of hyposulphite solutions, purposely more or less decomposed by doses of acetic acid and salts of silver. There was no mystery about this; a clever dodge was the term applied to any of these obnoxious and deleterious mixtnres, and a too

confiding public made their collections, paid their money, and were thankful. Both photographers and the public were blissfully ignorant; but now a strong ray of light has dispelled, in this direction, the mists which enveloped the dark ages of our art, but alas! the misdeeds of a former epoch are still a thorn in the flesh, and the confidence of those, who would be buyers and collectors, has been decidedly shaken. I said that a few paragraphs would be sufficient for the purpose of showing what has been done towards rendering silver prints more permanent, I should rather have said a few lines, for the use of the separate colouring bath, and the employment of fresh hyposulphite of soda solutions are, in reality, the only wholesome steps that have been taken towards improvement, which commend themselves to my mind.

It has lately been suggested that each print should be fixed separately in the hyposulphite of soda bath, stress being laid upon this being done in yellow light, with a view to permanency. I have, for at least ten years, advocated the practice of fixing and toning in yellow light, and the necessity for fixing only a few prints at a time in the bath, constantly moving them, which is equivalent to the plan suggested and more practicable.

With regard to a short immersion of the prints in a concentrated solution of the hyposulphite of soda, viewing the matter theoretically, I cannot see wherein lies the advantage of this method.

Let any one attempt to express himself freely, and

yet, at the same time, feel anxious not to offend the prejudices, or interfere with the interests of those with whom he may differ in opinion, and he will find the task no easy one; but I have promised to consider what it is proposed to do, in order to render silver prints more permanent, I must therefore proceed with this part of my subject, as it becomes the duty of every one interested in the advance of photography, to criticise these suggestions as they arise.

We have been troubled with a great deal of science, but treated to very little common sense in relation to photographic subjects; the doctoring of our prints has engaged the attention of all sorts of people—doctors of divinity, doctors of medicine, doctors of philosophy, amateur photographers—who are sometimes good pioneers—collodion compounders, and varnish makers have one and all given us their views, and in some cases their preparations, for achieving that success so devoutly to be wished for.

Not very long ago pure science was busy in showing how we might detect minute traces of hypo-sulphite of soda, left in the prints: all this was very interesting, but practical men naturally preferred spending their time in getting rid of their enemy, by adopting a process of ejectment, which they knew must be complete, rather than run any risk from the employment of half measures, notwithstanding, in this latter case, the pleasure which a careless person might derive from being able to prove scientifically that he was a dirty fellow. Again, as a reward for this kind of merit, peroxide of hydrogen was recom-

mended as an agent for converting the noxious into an innocuous compound. I speak with all respect of this suggestion, for achieving, in an elegant manner, that which the originator had in view; it appears, however, to me unnecessary and a step in the wrong direction; moreover, hampered with difficulties, viz., the difficulty of preparing the chemical, the difficulty of keeping it, in a pure state, when prepared; and lastly, its uselessness, when a little more water and care would render its application unnecessary. Peroxide of hydrogen gave one or two small puffs, and then very properly expired.

I come now to consider the latest suggestions, viz., the methods proposed for impregnating the prints with varnish or collodion. There is very little chance of photographers adopting the method with varnish of either known or unknown composition, certainly not the latter. All varnishes, sooner or later, acquire colour, the purity of the whites of the photograph would therefore be subject to injury; moreover, photographs have been varnished before to-day with spirit varnishes, and have yet faded: there is also something objectionable in the appearance of prints so treated. Lastly, collodion, as a new sensation, has made us raise the eyebrow of astonishment; the novelty of the suggestion consists in the fact, that the collodion is recommended to be well smeared over, on both sides of the print. It is really difficult to consider with a calm spirit this last suggestion; every one knows that a collodion negative unvarnished, soon becomes affected, if exposed to

atmospheric influences, owing to the change which easily takes place in a body that owes its existence to a compound so unstable as peroxide of nitrogen; how much more, therefore, will this be the case when the homogeneity of the film is broken up by its intermixture with fibrous matter, rendering it more easily acted upon, not only by the atmosphere, but also by its contact with organic matter left in the paper.

It is not to be supposed for a moment, that these thoughts have not occurred to, and been carefully weighed by the many acute minds engaged in the investigation of photographic matters. For very good and sufficient reasons, both the varnish and collodion suggestions for preserving our prints, have never found, nor are they likely to find, advocates among the thoughtful. Fallacious experiments with sulphide of ammonium have been made, for the purpose of proving the superiority of collodion over varnish, and *vice versâ*, for rendering prints permanent. This test is a mere snare and a delusion; it is not possible to anticipate the effect of time on such substances.

It will be said that nothing is so easy as to find fault, and nothing so difficult as to point out methods not open to objections of some kind or another. The only difficulties that really exist, and now impede the onward course of photography, are those which owe their existence to the use of improper mounting materials, and the omission of a proper application, to the surface of the print, of a preservative substance.

There is no reason why a photographer should not be able to stamp his proof, at once, with such a title as this, "permanent as any water-colour drawing, if kept with equal care;" let such print bear the name of "Encaustic Photograph," and a slightly increased price charged for photographs so stamped. I believe that it is only necessary for photographers to avail themselves of some plans, that have already been described, and which I am now about to recommend, in order to satisfy both themselves and the public as to the truth of their announcement; indeed, there can be no doubt about the matter, for I hold in my possession substantial proofs of the assertion.

If I had merely new and untried methods to suggest, it would surely be presumption to write in this strain; but I have, fortunately, only to gather together simple truths, and to present them as a whole, for the thoughtful consideration of those who really are anxious about the stability of their work; and this brings me to the third and practical part of my subject.

There are three operations to which the finished print should be subjected, after the *most perfect* washing, in order to render it permanent.

First, when quite dry, it should be perfectly rolled previous to mounting. If regarded with a view to permanency, the operation of rolling, when mounted on cardboard, is useless. Consider for a moment the state of the paper, and the arrangement of the metallic particles forming the picture: the paper has been by the various operations loosened in texture,

the size made more spongy, perhaps partially dissolved out, and the precipitate of silver salt, reduced by light, is in as divided a state as it is possible to conceive; but how easy by means of suitable pressure, to alter this condition, and not only restore the paper to its original compactness, but by compression of the silver particles, bring about a change of structure, which shall then more clearly represent a compact metallic layer, no longer absorbent and easily acted upon by every deleterious breath.

We all know how in nature substances that have exactly the same chemical constitution behave differently, according to the arrangement of the particles of which the body is composed; take, for example, dolomite—magnesian limestone—which, in the same quarry, is found both in the amorphous and crystalline states; the first is easily acted upon by the sulphurous and ammoniacal gases found in the atmosphere of cities, and readily crumbles away; the other, being compact, presents a harder surface, and resists for a long period these agencies. The magnesian limestone used for building a great part of the Houses of Parliament, is an example of the kind first mentioned, whereas the crystalline magnesian limestone forms one of the best and most durable of stones for building purposes.

Take another example,—most people are acquainted with Dobereiner's hydrogen lamp, used as a means of obtaining a light; by a suitable arrangement, a jet of pure hydrogen is projected through the air on to a ball of spongy platinum, that is,

the metal platinum in a finely divided state, the hydrogen becomes ignited by the intense heat produced, owing to the condensation of the oxygen of the air in the pores of the metal, and its rapid union with the hydrogen in the presence of platinum. This is a startling illustration of the peculiar influence possessed by this metal, and not by this body alone, when in a finely-divided state; but replace it with platinum foil, which is the same metal subjected to pressure, and no such result can be produced, because the particles of the metal are not so divided, and, consequently, a sufficient number of surfaces are not simultaneously exposed to the action of the gases.

These two illustrations show how the porosity and divisibility of bodies affect their stability and powers of influencing chemical change.

I think it follows that the first step towards obtaining the permanency of photographs must be taken in the direction thus pointed out; I mean the application of as much pressure as the paper will bear, for the purpose of bringing about metallic compactness; and this before mounting, for it is obvious that, with a card intervening, no suitable pressure can be brought to bear on both the surfaces of the photograph, without which a satisfactory result cannot be obtained. Secondly.—Many preparations of wax have been recommended for protecting the surface of a photograph: those that are liquid I consider objectionable; they give a flat and unctuous appearance, very disagreeable to the eye. That wax

most materially assists in the preservation of photographs, is beyond all doubt. I have two photographs that have been so protected for twenty years, they are as fresh as when first printed; one, the portrait of an old woman, then 104 years of age, by Mr. John Stewart, of Pau, a distinguished amateur photographer; this portrait is likely to rival the original in antiquity. The other referred to, is in every respect as fresh; they were both printed and prepared with wax by the gentleman named.

It is unnecessary to multiply instances of the encaustic properties of wax. It is well known that the paintings upon the walls of Pompeii owe their freshness to the use of some such preparation; and having myself photographed some of these paintings, I can speak, as an eye-witness, as to the marvellous state of their preservation.

It remains only to point out how to use this substance with advantage. From trials I have made, I find that a cerate, composed principally of oil of lavender and wax, with gum elemi, sufficiently firm to admit of its being conveniently rubbed into the surface of the print with a suitable brush or tuft of cotton wool, is by far the best and most convenient preparation to use; half a minute's application—for a small picture—is enough. It should be rubbed perfectly over the surface of the photograph; sufficient may be used to leave a slight excess unabsorbed; it need not be made to penetrate beyond the layer of albumen, although it should be well rubbed in; the print is not, therefore, rendered translucent

by its application. Let the photograph so prepared remain half an hour before removing the excess with a suitable rubber. Before applying the cerate take care that the photograph be thoroughly dry.

The prints will be improved in appearance by this process of waxing, and the darker parts rendered more transparent; the surface of the photograph so treated, when dry, is capable of taking a certain amount of polish, using for this purpose a tuft of cotton wool, giving it a circular motion.

To keep the photograph quite flat, and to prevent creasing whilst applying the cerate, use a mounting board that has been prepared with india-rubber solution; touch the edges of the photograph with a little solution, when dry, it will then adhere to the board, and lie flat; it can easily be taken up when impregnated with the cerate.

Thirdly, the photograph should be rendered as much as possible impervious to moisture, and its pores filled up with an innocuous substance. We have had for some time the means of doing this perfectly with solution of india-rubber. I again strongly recommend it for both mounting and preserving our photographs; it possesses some peculiar properties specially adapted to the purpose. The solution of india-rubber in benzole fills up the pores of the paper without penetrating the surface, and leaves sufficient body of india-rubber, when dry, on the back of the photograph to form an adhesive surface.

INSTRUCTIONS FOR MOUNTING.—Brush the india-rubber solution evenly over the back of the photo-

graph, set it aside to dry spontaneously, when dry, trim it to the required size;* prepare the mount in a similar manner, covering a space a trifle larger than the photograph. *When both have become quite dry,* which takes place in a few minutes, place the photograph carefully in the position it is to occupy on the mount, and smooth it down with a cloth; do this systematically, commencing at one edge along one side of the picture, thus chasing away the air as it falls into position; contact at first should be lightly made, that the print may be taken up easily, if wrongly placed. Now, with a piece of clean white paper intervening, use the thumb or a suitable pad, for pressing it more closely to the mount, perfect union will then be obtained. In order to produce strong adhesion, pass the photograph thus mounted through the press. Lastly, remove any excess of india-rubber from the mount, by simply rubbing it off with a white cloth, cambric handkerchief, or piece of india-rubber; this is most easily effected, without leaving the slightest stain. As a good mountant, for all purposes, this preparation is invaluable. Should the solution become too thick it may be thinned with benzole.

Nothing can be more satisfactory than this method of mounting, it accomplishes all that we have in

* Drive off all moisture that may be present in the photograph and in the mount, by holding both to the fire before coating them with the solution. Many fail to produce adhesion between the two surfaces by not using sufficient of the india-rubber solution. Two applications, drying between each, may sometimes be advantageous.

view at one operation, fills up the pores of the paper with the very best substance for resisting moisture, and forms, at the same time, a most admirable mountant, clean and easy of application; an increased appearance of solidity is also given to the photograph; another advantage it possesses, over all other mountants, is the absence of cockling of the mount, even when of the thinnest kind.

Now it has been stated, that no proof can be shown of the deleterious nature of aqueous mountants; the fact that these materials, so easily acted upon by moisture, must tend to the destruction of the photograph, is so obvious as to need hardly a bare statement. The paste, used in the manufacture of the cardboard, may also have an injurious effect. but a layer of india-rubber protects the proof from immediate contact with any such enemy.

That photographs not mounted remain longer unchanged than those mounted, as hitherto, is well known, and may be adduced as corroborative evidence of these views.

Albuminized paper has been objected to, as having within it sulphur, which is supposed to combine with the silver, and therefore, whatever care be subsequently taken, the compound thus formed cannot be expelled. If this be true, all prints on albuminized paper should fade, but such is very far from being the case, proving the theory to be erroneous. That albumen of egg does contain a slight trace of sulphur, we may perhaps credit on the authority of the books, but in what state of combination it exists, we are not

told; most probably so organically blended, as to defy any process of separation, short of the destruction or alteration of the properties of the albumen. There is certainly no proof that a sulphide of silver is formed, on exciting a sheet of albuminized paper, but rather the contrary. My own experience tends to show, that prints on albuminized paper* are less liable to change than those on plain paper.

The fact is, there has been too much hair-splitting in the chemistry of photography, but an indifference about that which is palpably wrong. We have been too hypercritical in small matters, and have swallowed grave errors wholesale. Had a hundredth part of the time that has been expended on impracticable processes, heralded with a brazen flourish of trumpets, been devoted earnestly to the improvement and permanency of silver prints, we should not now have to speak of them so frequently in disparaging terms. I believe that a change in our system of finishing photographs, will be conducive to a vitality in photographic affairs, satisfactory to all. Photography has become, and will continue to be under all circumstances, a necessity. It is enough that attention is now being earnestly directed towards the end all have in view, viz., the permanency of silver prints. It only remains to put to the test of time the various

* I refer to paper prepared with fresh albumen, for decomposed albumen contains sulphuretted hydrogen. A large quantity of foreign albuminized paper is imported into this country. For the purpose of obtaining a high glaze, stale albumen is employed; this paper may easily be detected by its smell. It should not be used.

means suggested; it will call for some exertion on the part of photographers; but if public confidence is to be regained, a new system becomes imperative, and I venture to predict that those who are pioneers in this work, will not only reap a good harvest, but gain the confidence and thanks of all interested in the progress of the art.

IS IT POSSIBLE

TO OBTAIN

PHOTOGRAPHS IN COLOURS?

HAVE colours, in the proper acceptation of the term, ever been produced in the camera? I unhesitatingly answer, No. Various shades of reduced silver, in combination with organic and other matter, are always evident on the surface of an under-exposed and developed negative, when the latent image has been produced under the most favourable conditions, impressed only by that light emanating from the object which is to make its mark on the sensitive surface, thus delineating, in a very subtle and perfect manner, the various grades of intensity of the various reflections, each charged with its quota of chemical action or power of effecting molecular change, and each impressing and disturbing the molecular arrangement of the silver salts according to its power, and that only. I should say that these shades of reduced silver reflect, as a property inherent in themselves, whatever colours may be seen, these colours being due to the differences in the molecular conditions of the silver salts reduced in variable degrees of intensity, and so assuming modified struc-

tures. The ultimate results are quite uninfluenced by any specific action of the colours of the object copied, apart from the variable chemical intensities of such colours inducing molecular disturbances in the silver salts, as before alluded to.

Whenever an appearance of colour has been observed on a sensitive plate, the whole picture generally has partaken of it. Any representation of colour resembling that in the object copied has been due to an accidental similarity in colour of the reduced silver and the object itself. I maintain that, from a given inorganic film or tissue, only a given set of shades of tints can be developed, these being produced by a graduated disturbance in its structure, and more or less partaking of a general hue. In tissues having no organism this seems so evident as hardly to need an elaborate statement, were it not that some think otherwise.

Chemists are acquainted with only definite and well-marked forms of metallic substances and their salts; but the more perfect and master chemist, light, is instrumental in producing as many grades of structure and shades of colour as there are rays in his beam. Now I fancy that more sanguine physicists may prefer to illustrate their views and corroborate their theories by an appeal to living organisms. Look at the petals of some flowers; how varied and beautiful yet how opposite are their hues. The gorgeous tulip will give us an illustration: in this case the uniform structure of the petal is apparent only, not real; the difference may be, even to the microscopist,

as undistinguishable as the principle which endows its form with life; nevertheless it must exist, and is no doubt a physical difference; for are not the same shades and colours reproduced in the same species year after year with wonderful and never failing regularity, showing that living substances obey, with a correct impulse, the order of their being? Art and culture are capable of blending and modifying the colours of a species, but, this effected, they remain distinct, subordinate to their organism.

The diversity of colour in the petals of a flower is not due primarily to the action of light; germination of the seed takes place in total darkness, but with it that wonderful organization springs which enables the young and tender plant to elaborate from the soil that food which is to influence its life and beauty, filling the cellular tissues, the fibrous and pulpy matters with those elements and chemical substances which, becoming changed by light, absorb and reflect the rays in modified and endless varieties, decking nature with so much loveliness.

I venture to think that these views are in accordance with the theory of colour as generally accepted. In this sketch I have endeavoured to show that both in the inorganic and organic world, order reigns in the production of colour. Nature knows no system of legerdemain, owns no issues brought about by conjuring tricks; all and everything must obey her laws; this is evident in all around us. Now, as the production of colours and the sensation they produce on the optic nerve are due to definite and perfectly

regulated rules of action, in what direction can we look for the accomplishment of the wishes, and for the corroboration of the views of those who conceive the production of natural colours in photographs to be possible? When a tissue has been discovered that contains within itself every molecular form, every kind of pulpy matter, every modification of cellular structure, every chemical substance, compound and simple, and, moreover, holds within itself the grand moving and vital principle, not even then will photographs in colours be produced; for a still more wonderful discovery must yet be made by the alchemist—the elixir that shall excite and develope all these untold members of the mineral and vegetable kingdoms in such a manner as shall call them forth arranged as in a landscape. No mortal may venture to raise his thoughts to the consummation of such expectations, which, in the natural order of things, must ever remain a dream, a chimera of the imagination.

APPENDIX.

TONING BATH WITH GOLD AND LIME.

THE following method of preparing and using this colouring bath, has been carefully worked out by an amateur, whose productions are so excellent that I gladly avail myself of his permission to publish the process, in his own words. I believe it to be the only way of using this bath that can be relied on; it never fails.

Make two solutions:—

No. 1.

Chloride of gold.....	15 grains.
Distilled water	15 drachms.

No. 2.

Chloride of lime.....	¼ ounce.
Water.....	8 ounces.

Warm a breakfast cup, fill it three parts full of *boiling* water.

Add from 2 to 3 drachms of Solution No. 1, neutralized first in a measure glass, by half a small teaspoonful of carbonate of lime.

Stir the mixture well, till the solution becomes colourless.

Put a pint of water into a porcelain dish; add the contents of the cup, stir well, and add of Solution No. 2, 1 drachm; stir again.

When first made, this lime bath should be kept three or four days before use. It ripens quicker if kept in the dish, with a china or glass cover to it.

When it ceases to tone, filter it into a china jug; cleanse the bath, replace the solution, and add 40 minims of No. 2; stir well. Make the gold solution in the breakfast cup as before, add it to the bath, which will tone after a few hours.

When the bath gets too full, throw away, before filtering, enough to allow for the quantity of new solution to be added.

Remarks.—It is not necessary to filter the bath the first time it is used, the carbonate of lime causes a cloudiness, but this is of no consequence. The filtering becomes necessary when fingers have been in the bath, and gold has been precipitated. The bath should never be wholly thrown away. Solution No. 2 keeps perhaps better if made in a double quantity; I never filter it, but merely use the clear supernatent fluid. It should be kept in a well-stoppered bottle. I find that the colouring bath improves by being kept in a dish with a cover, where a certain amount of air reaches it, the evaporation diminishes it advantageously. I know always by the smell, whether the condition of the bath is right. There should be a faint, not a pungent smell of the lime.

BATH WITH GOLD AND ACETATE OF SODA.

Chloride of gold	3 grains.
Acetate of soda	1 drachm.
Water	20 ounces.

This bath should be prepared twenty-four hours before it is required for use; it keeps well, and only needs strengthening from time to time with more of a freshly-made solution.

AMMONIO-SULPHATE OF IRON DEVELOPER.

Ammonio-sulphate of iron.....	25 grains.
Glacial acetic acid	15 minims.
Alcohol	½ drachm.
Water	1 ounce.

A preference is given by some to the above formula.

SULPHO-GELATINE SOLUTION.

Cover perfectly 3 drachms of gelatine with cold water, let it soak for twelve hours, then pour off the water and press the gelatine gently with a glass rod to remove a further portion. Place the moistened gelatine in a glazed porcelain vessel, and pour upon it one fluid ounce of sulphuric acid, stir well with a glass rod; when the solution is quite cold dilute with about four ounces of water, and neutralize with the strongest liquor ammonia, taking care that the solution gives a slightly alkaline reaction.

When cold, add half an ounce of glacial acetic acid, filter, and make up with water to sixteen ounces.

To make the developer, dissolve from 25 to 40 grains of protosulphate of iron in an ounce of water, and add from 30 minims to 2 drachms of the sulpho-gelatine-solution. No alcohol is required.

OPINIONS OF THE PRESS.

From the ATHENÆUM.

"There is considerable merit in this treatise. It is clear and concise, and the work of a careful chemist, long practised in the preparation of the most delicate photographic compounds. Any one, carefully following the directions given by Mr. Thomas, bearing in mind that none of the manipulatory details must be neglected, will soon become a photographer.

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upon collodionised plates;' 'On cleaning the glass plate;' 'On varnishing negatives;' 'On printing;' 'On the cause of fogs, stains, and streaks in the negative.' These, with many excellent hints of a miscellaneous nature, form the bill of fare presented in this work.

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"The value of the art of photography to medical and scientific men as a means of recording the experience of the eye, for the after use of themselves and others, is now so fully appreciated that we are glad to be able to speak favourably of a small treatise on its practice by Mr. Thomas, and to recommend it to those of our readers desirous of taking up the art. As far as can be, the author seems to have ensured successful results to the amateur who carefully follows his directions. The particulars of each step in the ordinary process are given in the form of a series of short essays. The theory of the subject is purposely omitted."

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A descriptive Catalogue of Photographic Apparatus and Chemicals, manufactured by the Author of this Treatise, will be sent on receipt of a penny postage stamp.

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